

OPERATING EXPERIENCE SUMMARY



Office of Nuclear and Facility Safety

October 20 – November 3, 1999

Summary 99-44

The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-95, change notice 1, September 1997, *Development of DOE Lessons Learned Programs*.

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EVENTS

1. BREATHING AIR SUIT DEFECTS

On October 19, 1999, at the Rocky Flats Environmental Technological Site, a worker performing decontamination and decommissioning activities in a contaminated room noticed a separation at an exhaust valve on his bubble suit when he exited the room and removed the suit. Radiological control technicians surveyed both the suit and the worker and found no contamination. A supervisor informed the quality assurance group about the defect in the suit. Failure of personnel protective equipment can cause personnel contamination or intakes of radiological contaminants. (ORPS RFO--KLL-771OPS-1999-0053)

Quality assurance investigators discovered additional defects in the worker's suit, as well as similar defects in other bubble suits that were in storage. They determined that the defects were limited to suits of one lot and one size from one manufacturer. They also determined that defects occurred at the seam of the velcro fastener and at the exhaust valves in all the suits they inspected. Inspectors believe that the glue holding the velcro and exhaust valves to the body of the suit lost its adhesive properties. They also determined that the suit manufacturer was using a new exhaust valve supplier and changed the suit design to accommodate the new valves, but did not notify the site quality assurance group of these changes in manufacturing.

Investigators determined that Rocky Flats quality assurance receipt inspectors performed only random checks on the suits upon delivery. EH engineers will follow the investigation and report any significant results or lessons learned in a future summary.

EH has reported a variety of similar problems associated with supplied-air breathing systems and powered air-purifying respirators across the DOE complex. Weekly Summaries 98-40, 98-33, 97-26, 96-52, 96-18, 95-36, 95-10, and 94-30 reported on these events. These summaries are available at www/tis.eh.doe.gov/oeaf/II.html.

Personnel are ultimately responsible for checking the integrity of their personal protective equipment before donning it and entering a work area. If they identify problems, they should return equipment to the point of issuance, notify supervisors, and inform an industrial hygienist or radiological technician. Managers must implement stringent quality assurance practices and acceptance criteria to reduce the amount of poor quality personal protective equipment at DOE sites.

KEYWORDS: Contamination, equipment defects, personnel protective equipment

FUNCTIONAL AREAS: Quality Assurance

2. TWO UNEXPECTED PERSONNEL CONTAMINATION EVENTS

On October 27, 1999 at Rocky Flats Environmental Technological Site, a process specialist using a nibbler in a glove box, for material reduction work, received 1,000 dpm alpha contamination to

his face, 3,000 dpm to his head and 500 dpm on his neck. Both the continuous air monitor and selective alpha air monitor alarmed during the operation and all employees in the room evacuated to the nearest hallway. Health physics personnel placed personnel who were working in the room at the time of the alarms on bioassays, and nasal smears were taken from the specialist. The process specialist wore basic anti-contamination personal protective equipment, but was not wearing a respirator because derived air concentrations were below 0.1 DAC, which is less than the required limit for respiratory protection. (ORPS RFO-KHLL-PUFAB-1999-0079). On October 27, 1999, at Los Alamos National Laboratory a technician became contaminated while sorting envelopes containing nickel clad plutonium foils. The technician received 5,000 dpm of alpha contamination to his right hand, and nasal smears indicated 87 dpm of alpha contamination. (ALO-LA-LANL-TA18-1999-0013). Incomplete work plans or pre-job surveys can result in contamination of personnel or equipment.

In the Rocky Flats event, investigators determined that while the process specialist was performing a reduction operation in a glovebox the nibbler jammed on the plutonium, so he leaned on the glass window to gain more leverage to dislodge the nibbler. Investigators believe that when he leaned on the window the seal broke and released the contaminant. In the Los Alamos event, investigators determined that the specialist wore no protective equipment and was handling the material with his bare hands. The Plutonium foils were clad with nickel and investigators have not determined how the cladding was breached. They also determined that the site Radiological Control Technician was not aware of the work the specialist was performing.

These events underscore the importance of control of radioactive contamination during the performance of work on highly contaminated equipment or special material. These events also underscore the importance of effective application of lessons learned and works planning for special work functions. Facility managers and supervisors should review the following documents. They should ensure that radiological worker training emphasizes the need for cautious attitudes and should outline the type of mistakes that can lead to contamination events.

DOE/EH-0256T, Radiological Control Manual, states: "Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity." The manual sets forth DOE guidance on the proper course of action in the area of radiological control. Site managers and employees should ensure they understand and can apply radiological control program requirements in the workplace to minimize radiation exposure. DOE-STD-7501-95, Development of DOE Lessons Learned Programs, discusses management responsibility for incorporating appropriate corrective actions in a timely manner.

DOE/EH-0420, Safety Notice 94-03, "Events Involving Undetected Spread of Contamination," provides guidance, good practices, and corrective actions to prevent the spread of contamination. This notice also contains information on common contributing causes, including (1) failure to follow applicable radiological protection procedures; (2) failure to adequately perform required surveys; (3) inadequate training for personnel involved in handling and use of radioactive material; (4) failure of radiation protection personnel to properly identify, analyze, and respond to the event; (5) failure to exercise appropriate precautions when handling radioactive material; (6) inadequate supervision or management oversight of activities involving handling and use of radioactive material; and (7) inadequate identification of existing contamination.

3. OPEN TANKER VENT RESULTS IN NITRIC ACID SPILL

On October 15, 1999, at the Savannah River Site H-Canyon Facility, a vendor delivering a load of 51 percent solution nitric acid failed to secure an open tanker vent, and approximately 5 gallons of nitric acid sloshed out, splashing a guard and an operator. The guard and operator immediately flushed the contact areas and went to the on-site medical unit for a shower and thorough examination. The on-duty physician found no apparent injuries and released them. A hazardous materials team responded to the incident, treated the spill area with sodium carbonate, and

cleaned up the waste for proper disposal. A preliminary investigation revealed that no Department of Health and Environmental Control, or Emergency Action Level declaration is required. Open acid containers can overflow and cause serious burns to individuals. (ORPS Report No. SR-WSRC-HCAN-1999-0049)

Investigators determined that the vendor connected the tanker's discharge hose and opened the tanker vent to prepare for acid transfer, but the hydraulic discharge valve malfunctioned making the transfer impossible. They also determined that procedures required disconnecting the transfer hose and closing the tanker vent, following an incomplete transfer. Attendees at an October 16 critique of the event determined that site procedure needed to be modified and that site operator escorts must verify that vendors follow the vendor delivery procedure.

NFS reported a similar event at a commercial nuclear power station in Weekly Summary 99-24. On March 9, 1999, a plant equipment operator and an operator trainee allowed the driver of a chemical tank truck to connect the truck, which contained 4,000 gallons of sodium hydroxide, to a partially full sulfuric acid storage tank. The driver had inadvertently misinformed plant security officers about the contents of the shipment by telling them the truck contained caustic acid and the security officers repeated this information by notifying control room personnel that acid had arrived on site. The operators discovered the error before the chemical transfer began and told the driver to disconnect the truck from the acid tank. If the sodium hydroxide in the truck had been off-loaded into the acid tank, there could have been a violent chemical reaction that could have caused extensive personnel injury and equipment damage.

KEYWORDS: nitric acid, tanker vent, acid spill, overflow, acid

FUNCTIONAL AREAS: Industrial Safety, Materials Handling, Procedures

4. WIREMAN RECEIVES HIGH VOLTAGE SHOCK FROM PRIMARY POWER SOURCE

On October 20, 1999, at the Nevada Test Site, a wireman working on a compressor sustained an electrical shock and burns to both hands and his right shoulder when he contacted 4,160 volts. The wireman attempted to disconnect some primary energized wiring from a Quincy compressor while he and a mechanic were performing diagnostic tests. The mechanic notified medical personnel who arrived within 10 minutes, stabilized the wireman, and airlifted him to the hospital. He was treated and released after 24-hour observation. This event is significant because a failure to recognize energized circuits can severely injure individuals. (ORPS NVOO-BNL-NTS-1999-0023)

While working on the compressor, the wireman and a mechanic were called to another job. The wireman did not de-energize the primary power circuit before he left the area because he anticipated returning to the work area in an hour. When the two workers returned to the area, the wireman completed diagnostic testing on the compressor and gave clearance to the mechanic to replace the drive coupler. As the wireman prepared to disconnect primary power, the mechanic began to replace the drive coupler. The wireman asked the mechanic for a wrench, then said that he did not need one. As the wireman was speaking, the mechanic turned toward him and saw him lying on the ground. Site managers assembled a fact-finding team to determine the root cause of this event and develop corrective actions. EH engineers will provide further information when the investigation is complete.

NFS reported a similar event in Weekly Summary 96-39. On July 18, 1996, at Sandia National Laboratory, an electrician was shocked when he accidentally touched the primary side of a fuse clip of a potential transformer. The fuse clip became energized during a power-factor insulation test on the primary-side bushing of a transformer. When the electrician felt the shock, he immediately leaned back into a sitting position then laid down for a few seconds. He was examined at a medical facility and released. The electrician was unaware that the test voltage

could be induced onto the secondary bus of the transformer. (ORPS Report No. ALO-KO-SNL-NMFAC-1996-0004)

KEYWORDS: electrical shock, test, primary power

FUNCTIONAL AREAS: electrical maintenance

FINAL REPORT

This section of the OEWS discusses events filed as final reports in the ORPS. These events contain new or additional lessons learned that may be of interest to personnel within the DOE complex.

1. WORK PLANNING AND DESIGN DEFICIENCIES CAUSE WORKER INJURY

On June 23, 1999, at the Oak Ridge National Laboratory, a worker in a waste storage area was struck on the arm by a remote-handling device, causing a laceration that required nine stitches. The device was designed for replacing a retrieval lanyard on a spent nuclear fuel canister. As workers performed a practice run of positioning the device and replacing the lanyard, a cable holding the device slipped off a lifting post and the device fell, cutting the worker's arm. Legacy waste project managers identified several serious concerns while investigating this event including: (1) the design of the device allowed it to fall and injure the worker, (2) the workers were not included in the design and work planning process for the use of the device, (3) facility personnel had difficulty implementing the work control process, and (4) work control documents lacked sufficient detail. (ORPS Report ORO--BJC-X10WSTEMRA-1999-0001)

Facility personnel designed and fabricated the remote-handling device as a corrective action for an event in which a steel cable attached to a canister of spent nuclear fuel separated during retrieval, and the canister dropped approximately 16 feet to the bottom of its storage position in a dry, shielded well. (ORPS Report ORO--BJC-X10ENVRES-1999-0004) The device is 16 feet long, approximately 16 inches in diameter, and cylindrical. It has opposing lifting posts at the top. During the practice run of the lanyard replacement using a dummy canister, workers were moving the device with a crane from a vertical to a horizontal position when one end of the choker cable used to secure the device to the crane slipped off its lifting post as the device rotated, allowing it to fall.

Investigators determined that the direct cause of this event was inadequate or defective design in that the device was not designed with a mechanism to ensure that the choker cable loops would not slip off the ends of the lifting posts. The design of the remote-handling device did not consider the consequences of positioning the device from the vertical to the horizontal position.

Investigators determined that the contributing causes were work organization and planning deficiencies. They identified the following deficiencies in the work control process and procedures.

- The work-planning time for the practice run was inadequate. Originally, there was no work package to control the practice run. The workers questioned the lack of work control, and work planners quickly put together a work package for the practice run. The hasty preparation of the work control package contributed to deficiencies in the work control process.
- A supervisor performed the pre-task hazard review with no input from the workers. The procedure that governs the hazard review requires workers to participate in the hazard-review process and to initial the hazard review to indicate their participation.

- Operations and health and safety personnel did not evaluate whether a formal lift plan for this job was required. Although investigators determined that a formal lift plan was not required, the evaluation should have been performed.
- The workers did not wear personal protective equipment (PPE) during the practice run. Wearing PPE designated for the actual evolution would have helped to evaluate the timing of the work, determine any difficulties related to wearing the PPE, and establish requirements to keep the workers' exposure as low as is reasonably achievable.
- The workers used a generic work instruction for the practice run that was written only for the removal of spent nuclear fuel canisters from similar wells. It did not address the use of the remote-handling device to reattach the retrieval lanyard.
- During the event, the supervisor at the scene was not experienced in the movement of spent nuclear fuel canisters.


Investigators determined that the root cause of this event was the lack of a design review that might have anticipated the problem. The designer of the remote-handling device did not consider the effectiveness of the lifting configuration when the device was moved from the vertical to the horizontal position with a simultaneous rotation due to the weight of the device. The design considered the device only in a vertical position. Additionally, neither the workers, safety and health representatives, nor key management personnel participated in the design review for the remote-handling device.

Facility managers have implemented corrective actions that address the direct, root, and contributing causes of the event. The design of new equipment should consider the handling of the equipment in the different phases of its use including (1) initial positioning, (2) positioning during job performance, and (3) post-job positioning. The design should also consider the relationship between the equipment being positioned and the equipment used to position it. Prior to initiating any activity involving the use of new equipment, operations personnel should be given an adequate amount of time to thoroughly inspect the equipment and make suggestions for design improvement. Design personnel should evaluate those suggestions and act upon them accordingly.

Supervisors should ensure that work planning and controls are applied to practice runs of new equipment that have potential environmental or health and safety impact. Appropriate subject-matter experts should review the work planning, and operations personnel should participate in hazard reviews, work planning, and the design of any new devices that they are required to operate or manipulate.

KEYWORDS: design deficiency, hazard analysis, hoisting and rigging, industrial safety, injury, operations, supervision, work planning

FUNCTIONAL AREAS: Design, Work Planning

From: Tom Rollow 
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EH Office of Operating Experience Analysis, EH-33

To: OES Distribution

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